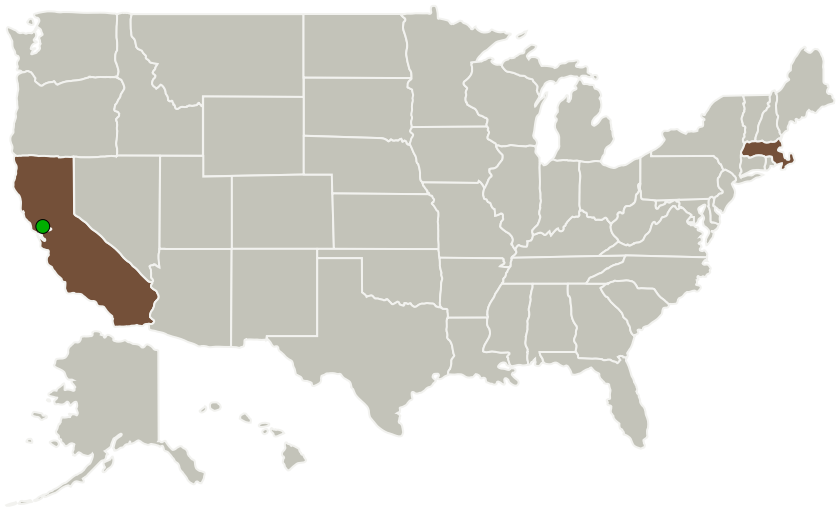
Drag Identification & Reduction Technology (DIRECT) for Elastically Shaped Air Vehicles, Phase I

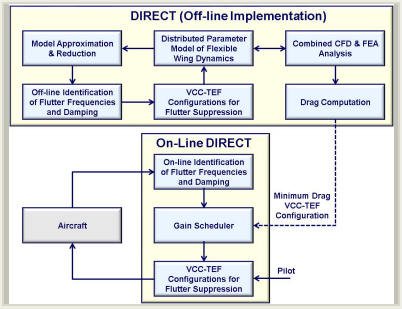
Completed Technology Project (2014 - 2014)

Project Introduction

NASA and Boeing Phantom Works have been working on the Elastically Shaped Future Vehicle Concept (ESFVC) and have shown that aircraft with elastically shaped wings have great potential to save fuel by minimizing drag. Main feature of the ESFVC is that it uses Variable Camber Continuous Trailing Edge Flap (VCC-TEF) flight control surfaces to bend & twist the wing to a "drooped wing" configuration that was shown capable of achieving drag reduction. However, elastic wings are characterized by reduced stiffness, which may result in lower flutter margins. Hence flutter suppression is an important aspect of the ESFVC. In order to address this technical challenge, SSCI and Boeing Phantom Works propose to design, implement and test an innovative Drag Identification & Reduction Technology (DIRECT) approach to drag reduction and flutter suppression in flexible-wing aircraft. The approach is based on leveraging prior work by SSCI and includes on-line identification of flutter modes using real-time subspace identification techniques, flutter suppression control law development, and the selection of the optimal control allocation that minimizes drag based on the CFD/FEA analysis. The approach will be tested on aircraft dynamics simulation, developed by Boeing, that includes a large number of relevant flexible modes. Boeing Phantom Works (Mr. James Urnes, Sr) will provide technical and commercialization support under the project.

Primary U.S. Work Locations and Key Partners





Drag Identification & Reduction Technology (DIRECT) for Elastically Shaped Air Vehicles Project Image

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Organizations Performing Work	Role	Type	Location
Scientific Systems Company, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Woburn, Massachusetts
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

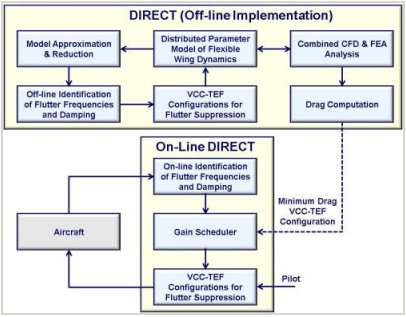
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140509)*

Images



Project Image
Drag Identification & Reduction Technology (DIRECT) for Elastically Shaped Air Vehicles Project Image *(https://techport.nasa.gov/image/135828)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Scientific Systems Company, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jovan Boskovic

Co-Investigator:
Jovan Boskovic

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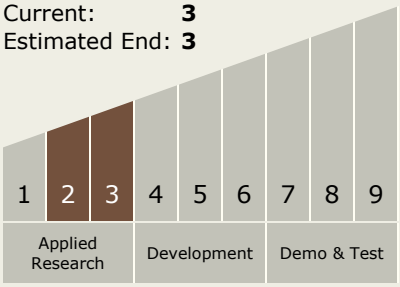
Completed Technology Project (2014 - 2014)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.1 Software Development, Engineering, and Integrity
    - TX11.1.6 Real-time Software

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System